1,107,160

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,107,160

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COMPLETE SPECIFICATION

A device for Selective Atomisation and Spraying of Various Materials

I, HANS BEHR, a German citizen, of Lenzhalde 82, Stuttgart-N, Germany, do hereby declare the invention, for which I pray that a Patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a device for selective atomisation and spraying of various materials, for example paints, in which there are provided, in a nozzle head, at least one passage for atomising air and a discharge nozzle for the selected spray material, the nozzle being selectively connectible to one of several supply lines for various materials.

Various such devices are known as spray pistols or atomisers for the spraying of paint. In one known device there is on the pistol body, a connection to which there may be connected, by hand, that supply line which supplies paint of a desired colour. With a change in colour the supply lines must be changed by hand. This device cannot therefore be used for automatic spraying plant or as an atomiser for electrostatic paint spraying. But even for non-automatic spraying the comparatively long time required to change from one colour to another is a disadvantage. Further, the paint in the connecting channel between the connection and the paint atomising nozzle is lost.

In another known device there is connected to the connection of the paint channel a connecting tube which is usually several yards long, leading to a colour selection apparatus where it can be connected to one of several different supply lines by sliding a sliding head or by turning a revolving nosepiece. The colour selection apparatus may be automatically controlled, so that no operator is required to change the colour. For this reason this form can also be used for electrostatic paint spraying. A disadvantage is that owing to the long connecting tube much paint is lost when the colour is changed. Moreover, in spite of the quick change-over at the colour selection apparatus, the change of colour takes a comparatively long time, as the old paint must first be forced out of the connecting tube and the paint channel before the new colour can be sprayed. In many cases in fact the connecting tube and the paint channel must be washed through when the colour is changed. This device is therefore not suitable for automatic spraying and enamelling, in which the cycle of operations allows only a little time for change of paint.

It is an object of the invention to produce a device which permits automatically controllable change from one material to another with the little loss and in a short time.

According to the invention there is provided a device for selective atomisation and spraying of different spray materials, for example different coloured paints, having a nozzle head with at least one passage for atomising air and a discharge nozzle for spray material, wherein feed passages for selectively connecting the discharge nozzle to supply lines for the different spray materials, are selectively closable by valves and lead into a short common flow passage which is in connection with and near to the discharge nozzle, the feed passages leading into the flow passage at a location spaced from that of the connection of the flow passage to the discharge nozzle.

Since the feed passages lead into a flow passage which is near the discharge nozzle, the length of path common to the different materials can be made very short. With a change of material only the material which is still in this path is lost, since when closed the relevant valve prevents material from entering from the relevant feed passage into the flow passage. Thus the loss is negligible. The change over time is short, since it is only

necessary to close the control valve of one feed passage and open that of another, which may be by means of an automatic control. Thus both for use as an automatic spray pistol and also as an atomiser, the apparatus of the invention satisfies the requirements including the supply of a number of different colours, which are limited only by the number of supply lines which can be arranged on the body of the pistol or atomiser.

It is convenient for a control valve to be arranged next to the end of a feed passage facing the nozzle head. In this way the amount of material in the part of the passage between the valve and the flow passage, which, when using a material of low viscosity, may run into the flow passage after closing of the valve, is small.

In one constructional form of the invention each feed passage is a pipe in a body to which is fitted the nozzle head and a conduit which connects the pipe to the head. This provides a very simple construction. It also makes possible a simple and advantageous form where the end of the pipe towards the conduit forms the seat of a valve, a valve spindle of which extends through the pipe.

In detail the design is such that the valve spindles, in the form of needles, may each be displaced against the force of a spring by air-actuated pistons. The control of the air supply may be automatic, for example in accordance with a programme.

Since no separate control is necessary for the supply of atomising air, which might lead to errors of synchronisation, each piston may be coupled with the spindle of a valve arranged in the atomising air lead for approximately simultaneous actuation of it, independently of the position of the other pistons. With one advantageous constructional form there is provided for this purpose a coupling device which has a plate arranged axially immovable on the spindle of the atomising air valve, a return spring for the spindle and axially immovable bars or the like connected with the piston and capable of being placed on the plate. In order that the atomising air valve shall always be opened before the material supply valve opens, and always closed only after the latter is closed, each piston may be connected with the corresponding needle through a spring. The movement of displacement of the piston is transferred to the needle with a time delay.

Two embodiments will now be described by way of example, with reference to the accompanying drawings, in which:—

Figure 1*a* is a longitudinal section through the head of a first embodiment;

Figure 1*b* is a longitudinal section through the body of the first embodiment;

Figure 2 is a section on line II—II of Figure 1*b*; and

Figure 3 is a part of a longitudinal section of a second embodiment.

Referring to Figures 1*a*, 1*b* and 2, in a cylindrical nozzle head or assembly 1 of an automatic spray pistol there is a common flow passage in the form of a blind bore 2. On its face remote from the blind bore the head or assembly 1 has four cylindrical depressions 3, arranged at the same distance from the outer edge and each displaced at 90° to another, into which open channels 4 from the blind bore 2. Their mouths 4^1 are widened in the form of a funnel. The diameter of the depressions 3 is appreciably greater than the diameter of the channels 4 and of the blind bore 2. Between the channels 4 there are bores 5 which pass through the nozzle block in a generally axial direction as shown in Figure 1*a*. These bores 5 open into a chamber 6 which is bounded by a cylindrical bush 7 mounted on the nozzle assembly and having a base, and also by one face of the nozzle assembly. In a concentric hole in the base of the bush and in a threaded hole in the nozzle assembly concentric with the blind bore is a paint discharge nozzle 8, the bore 9 of which is connected with the blind bore 2 and, through air channels 10, with the chamber 6.

The nozzle assembly 1 is attached to one end of a cylindrical tube 11, which at the other end is attached to a body 12 (Figure 1*b*). On the face 13 turned towards the nozzle assembly 1 the body 12 has blind bores 14, which have the same diameter, the same distance from the longitudinal axis and the same angular spacing as the depressions 3. The blind bores 14 and depressions 3, which face one another, are connected together by means of tubes 15. To each blind bore 14 there is connected, by a radial channel 17, a connecting piece 16.

In the centre of the end face of each blind bore 14 is a guiding channel 18 in which is a needle 19, which extends through the tube 15 to an end 19^1 at the mouth 4^1. This end 19^1 is conical and corresponds to the shape of the mouth 4^1. The mouth 4^1 and the end 19^1 constitute a valve assembly.

The other end 19^{11} of each needle 19 is an annular space 20, which is formed by the body 12 a cylindrical body 22 connected with it, and a sleeve 23 fitted on the two bodies. The space 20 is sealed against the blind bores 14 by washers 21.

The body 22 has, on the same axes as the needles 19, bores 24 extending over part of the axial length of the body 22, to which are connected guide bores 25, also on the same axes, extending to the space 20. In each bore 24 a piston 26 is slidable, being seated at one end of a rod 27 guided in the guide bore 25. The other end of each rod 27 is connected by a spring 28 with the end 19^{11} of one of the needles 19. The space 20 is sealed against the bores 24 by washers 29.

In the end of each bore 24 remote from

the guide bore 25 is screwed a threaded, apertured plug 30 which forms a stop for a compression coil spring 31, whose other end abuts the piston 26. Each plug 30 has a central aperture 32, through which projects a rod 33 fixed to the piston 26 and the rod 27. The part of each bore 24 between the piston 26 and the guide bore 25 is connected through a radial channel 34 with a connecting piece 35 for control air supply.

The body 22 has also a central bore 36 which extends there-through, and to which is joined a central bore 37 of the body 12 which extends there-through. The bore 36 is connected with a connecting piece 39 (Figure 2) for the atomising air line by a radial connecting channel 38 (see also Figure 1*b*) between the radial channels 34. For controlling supply of atomising air through the bore 37 to the tube 11 and thence to the nozzle assembly 1, the bore 36 has a control valve arrangement 40. Attached to a valve spindle 41, axially movable in the bore 36, is a cut-off member 42 which shuts off or allows the passage of atomising air from the radial channel 38 into the part of the bore 36 lying between the channel 38 and the bore 37, according to the position of the valve spindle 41. This part of the bore 36 is reduced stepwise in diameter, as shown in Figure 1*b*. A piston 43 arranged on an extension 44 of the valve spindle 41 acts, with this reduced bore part, as a throttle which enlarges the cross section of the channel stepwise on opening the valve for the atomising air.

On the other end of the spindle 41 a disc 45 is fixed, and against it lies a pre-stressed compression coil spring 46, whose other end abuts a cap 47 on the body 22. The side of the disc 45 away from the spring 46, in the closed state all the valves 4^1, 19^1, lies against the free ends of all the rods 33, or are at a slight distance from them.

When control air is admitted to one of the pistons 26 the rod 33 is moved, so that the disc 45 and the valve spindle 41 are also moved. The atomising air can now pass to the bore 9 of the nozzle 8 through 38, 36, 37, 11, 5 and 10. Owing to the inertia of each needle 19 and its connection with its rod 27 by means of spring 28, the needle 19 follows the movement of the piston 26 after a small time lag. The supply of paint from a tube 15 into a channel 4 and the blind bore 2 thus only occurs after atomising air is already flowing through the nozzle bore 9. This ensures that no drops of paint come out of the nozzle 8. The other pistons 26 are not affected by the displacement of that piston 26 which is acted on by control air. To stop spraying or to change the colour, the control air supply channel 34 of that piston 26 which is open is vented so that spring 31 can return piston 26 to its start position. The needle 19 follows after a slight delay and closes the paint supply. Return of the cut-off member 42 to the closed position by the spring 46 takes place with a somewhat greater delay, so that atomising air still flows through the nozzle bore 9 after the supply of paint has been cut off. The resulting reduced pressure causes the blind bore to be virtually sucked dry. This is advantageous, as when the colour is changed the blind bore is free from residue of the previous colour. For changing the colour it is now only necessary to open the supply of control air to another piston 26.

Thus for control of the device and of colour change, only the supply of control air needs to be controlled. Automatic control is therefore relatively inexpensive, and the change-over time for a change of colour is small.

The embodiment of Figure 3 for electrostatic spraying is distinguished from that of Figures 1*a*, 1*b* and 2 by a different formation of the head and, owing to the high voltage on the nozzle assembly, the nozzles, the pipes connecting the head with the body, and the body, are not of metal but of a non-conducting material, for example a plastics material.

An air nozzle 151 is mounted on a nozzle assembly or head 101 by a plastic clamping nut 150. A paint discharge nozzle 108, which is screwed in a threaded hole concentric with a flow passage in the form of a blind bore 102 for supplying the paint and the bore 109 of which forms a continuation of the blind bore 102, is formed externally so that between its frusto-conical face and cylindrical outer surface on the one hand and the wall of the hollow space 152 on the other hand there is an intermediate space through which air can flow to a mixing jet 153 where it is mixed with the paint from the nozzle bore 109, for atomisation.

On its front face the air nozzle 151 has two projecting, diametrically opposed horns 154, 154^1, in each of which is a channel 155, 155^1. These channels are connected at one end to air channels 105 of the nozzle assembly and at the outer end with atmosphere through channels 156, 156^1, which are so arranged that the compressed air from them continues the atomisation of the jet leaving the mixing jet 153 and imparts to it a flat form.

The widened part of the hollow space 152 facing the assembly 101 is enclosed by an electrically conducting ring 157, for example of brass, with which are connected in electrical contact metal strips 158, 158^1 which engage in the channels 155, 155^1 and are provided with points. Electrodes 160 or 160^1, which are countersunk, contact these strips in channels 159, 159^1.

The ring 157 is at the knee position of a contact 161, which is bent at an angle and is mounted in the nozzle assembly 101, with one arm in the blind bore 102 and the other arm in a depression 162. In this depression

162, in which a tube 163 is inserted, the contact 161 engages a contact ball 164 which is under the action of a coil spring 165. In the space enclosed by the coil spring is a current limiting resistance (not shown) which has one end against the ball 164 and the other end against a high voltage supply.

The other parts of the atomising spray device are the same as the device of Figures 1a, 1b and 2.

When the contact 161 carries high voltage, paint to be atomised is electrostatically charged by the arm projecting into the blind bore 102 before it reaches the nozzle 108. In addition the compressed air supplied is ionised by the edges of the ring 157 and the edges and points of the strips 158, 158[1]. This has the result that the paint particles are already electrostatically charged at the jet 153 and then by further atomising and forming of the jet by the compressed air from the channels 156, 156.[1] This arrangement produces an intense electrostatic charge. Additional ionisation is produced by the electrodes 160, 160[1]. Control of the paint supply and atomising air, and also of colour change, is the same as in the previous embodiment.

WHAT I CLAIM IS:—

1. A device for selective atomisation and spraying of different spray materials, for example different coloured paints, having a nozzle head with at least one passage for atomising air and a discharge nozzle for the spray material, wherein feed passages for selectively connecting the discharge nozzle to supply lines for the different spray materials, are selectively closable by valves and lead into a short common flow passage which is in connection with and near to the discharge nozzle, the feed passages leading into the flow passage at a location spaced from that of the connection of the flow passage to the discharge nozzle.

2. A device according to claim 1 wherein each valve is close to the end of the associated feed passage and is directed towards the nozzle.

3. A device according to claim 2, wherein each feed passage includes a portion in the head, a conduit leading from the said portions to convey material to the nozzle.

4. A device according to claim 3, wherein an end of each said portion is directed away from the nozzle and forms the seat of the valve, a valve spindle extending through a tubular portion of the feed passage.

5. A device according to claim 4, wherein each valve spindle has a piston adapted to be moved by compressed air against a spring force.

6. A device according to claim 5, wherein each piston is coupled with the spindle of an atomising air supply line valve, to permit substantially simultaneous actuation of that piston and valve independently of the position of the other pistons.

7. A device according to claim 6, wherein a coupling device comprises a plate axially fixed on the spindle of the atomising air supply line valve, a return spring for the said plate, and rods movable by the plate and connected in axially immovable manner with the pistons.

8. A device according to claim 6 or claim 7, wherein each piston is connected with the corresponding spindle by means of a spring.

9. Devices for selective atomisation and spraying of various materials, substantially as herein described with reference to the accompanying drawings.

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Fig. 1a.

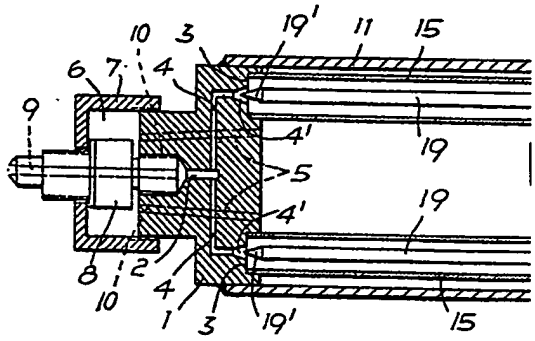
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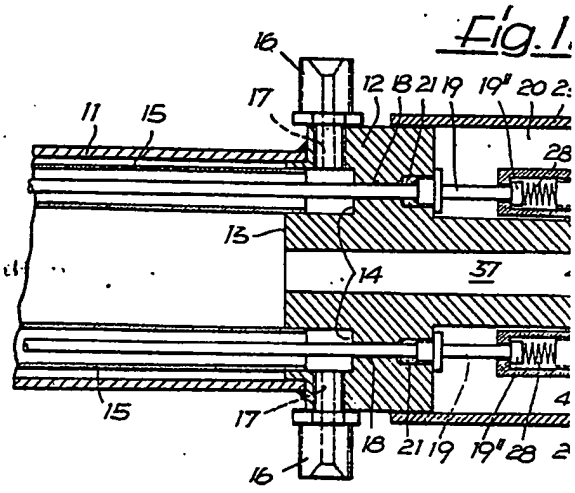
Fig. 1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Sheet 1

Fig. 2.

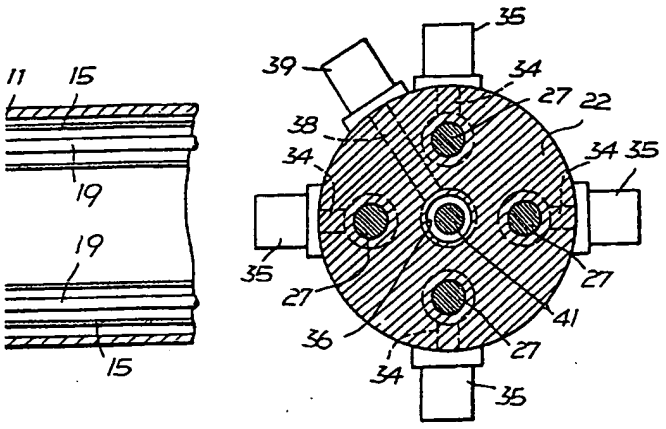
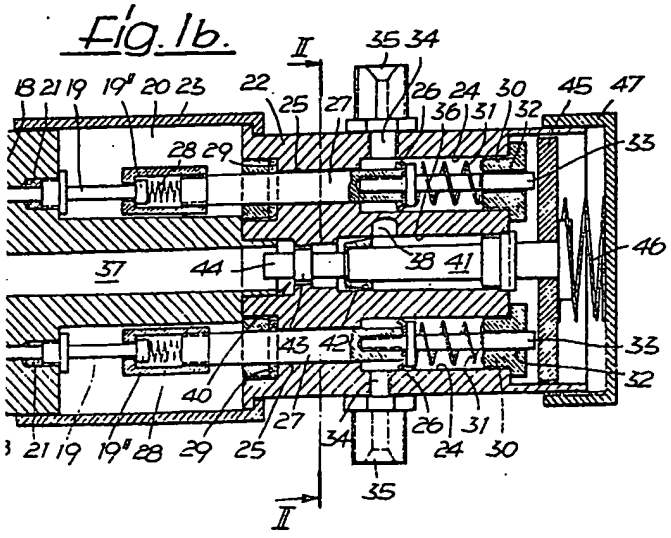


Fig. 1b.



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Sheet 1

Fig.1a.

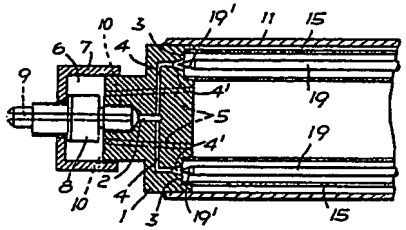


Fig.2.

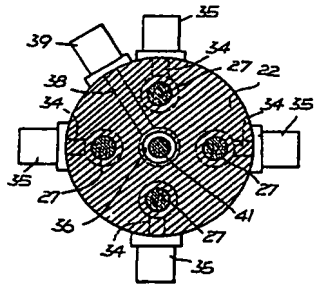
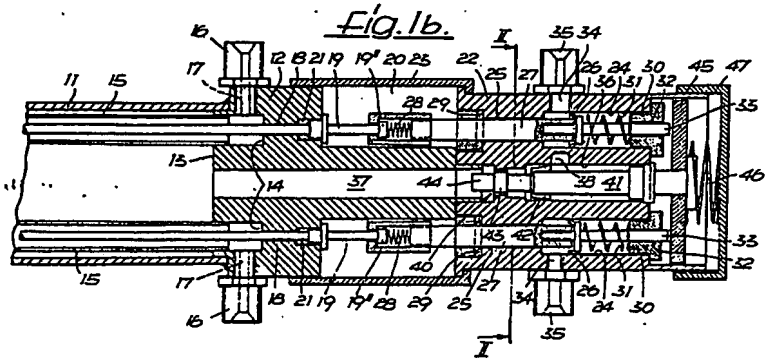


Fig.1b.



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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

Fig.3.